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A COMPARATIVE STUDY BETWEEN THE OUTCOME OF PRIMARY REPAIR VERSUS LOOP ILEOSTOMY IN ILEAL PERFORATION

Original Research

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ABSTRACT

Background: Ileal perforation is a critical surgical emergency associated with high morbidity and mortality if treatment is delayed. Among the management strategies, primary repair and loop ileostomy are the most commonly practiced procedures, yet the choice between them remains debated. Each approach carries distinct risks and benefits, and outcomes may vary depending on patient selection, intraoperative findings, and healthcare resources. Establishing evidence-based guidance is essential to optimize treatment strategies and improve survival in affected patients.

Objective: To compare the demographic, clinical, and postoperative outcomes of primary repair versus loop ileostomy in patients with typhoid-associated ileal perforation.

Methods: This randomized controlled trial was conducted over six months in a tertiary care hospital and included 70 patients aged 13–60 years presenting with ileal perforation within 48 hours of symptom onset. Patients were randomized into two groups: Group A underwent primary repair (n = 35) and Group B underwent loop ileostomy (n = 35). Demographic data, clinical presentation, and postoperative complications were recorded. Patients were followed for one month. Statistical analysis was performed using SPSS version 26, with chi-square and independent t-tests applied. A p-value ≤ 0.05 was considered statistically significant.

Results: Baseline characteristics such as mean age (31.8 ± 10.5 vs. 32.6 ± 11.2 years, p = 0.678), gender distribution (male: 68% vs. 66%, p = 0.831), and BMI (22.4 ± 2.7 vs. 22.9 ± 3.1 kg/m², p = 0.451) were comparable between the groups. Postoperative outcomes, however, differed significantly. Surgical site infection was higher in the loop ileostomy group (50%, n = 18) compared with the primary repair group (20%, n = 7; p = 0.001). Mean hospital stay was significantly prolonged in loop ileostomy patients (12.4 ± 3.3 days) versus primary repair (7.6 ± 2.1 days; p < 0.001). Electrolyte imbalance occurred in 36% (n = 13) of loop ileostomy patients compared to 8% (n = 3) of primary repair patients (p = 0.001). Mortality was slightly higher in the ileostomy group (6%, n = 2) compared with primary repair (2%, n = 1), though not statistically significant (p = 0.307).

Conclusion: Primary repair demonstrated superior short-term outcomes compared with loop ileostomy in patients with typhoid-associated ileal perforation, showing lower complication rates, reduced hospital stay, and fewer electrolyte imbalances. Loop ileostomy should remain reserved for unstable patients or those with extensive contamination. Careful patient selection and adherence to standardized surgical protocols can improve prognosis in this life-threatening condition.

Keywords: Anastomosis, Ileal Perforation, Ileostomy, Morbidity, Postoperative Complications, Surgical Site Infection, Typhoid Fever.

INTRODUCTION

Small bowel perforation represents a serious surgical emergency with significant morbidity and mortality if diagnosis and intervention are delayed. The condition commonly arises from inflammation, infection, obstruction, trauma, or invasive procedures, and patients typically present with abdominal pain and distension in the appropriate clinical context (1). Among causes of perforation peritonitis, the distribution varies geographically. In the Indian subcontinent, duodenal ulcer accounts for nearly half of cases, followed by typhoid fever, trauma, appendicitis, and tuberculosis (2). In contrast, infectious etiologies are far less common in the Western world, contributing to only a small proportion of cases (2). Recent evidence from Pakistan has highlighted a resurgence of ileal perforations due to Salmonella Typhi, particularly strains demonstrating extensive drug resistance (XDR), raising serious concerns about treatment outcomes and public health implications (3). Mortality associated with drug-resistant salmonella has been reported around 1.8%, with ileal perforation identified as the most frequent complication (4). Typhoid perforation thus remains a pressing challenge in developing countries, where it continues to be associated with high mortality and morbidity. Early recognition, preoperative resuscitation, and prompt surgical intervention are critical in improving survival (5).

Various surgical procedures have been employed to manage typhoid ileal perforation, including primary repair, ileostomy, and resection with anastomosis. Historically, ileostomy was preferred as a lifesaving procedure, especially for unstable patients, as it prevents the risk of anastomotic leakage (6). However, in recent decades, primary repair has gained attention due to lower costs and avoidance of stoma-related complications. Despite these advantages, primary repair carries the risk of leakage, fistula formation, or peritonitis, while ileostomy itself is associated with complications that may significantly affect quality of life (7). Consequently, no universally accepted surgical approach has emerged for managing typhoid perforations. The reported rates of postoperative wound infection add further complexity to the debate. Some studies have indicated higher infection rates following primary repair compared to ileostomy (8), while others have demonstrated the opposite trend, with ileostomy linked to significantly higher rates of surgical site infections (9,10). Such conflicting findings underscore the absence of consensus and highlight the need for well-designed comparative studies, particularly in the context of drug-resistant Salmonella infections, where management challenges are compounded. In view of the rising prevalence of resistant Salmonella Typhi strains and the continuing uncertainty regarding optimal surgical management, this study was undertaken to compare the rate of surgical site infection in patients undergoing ileostomy versus those undergoing primary anastomosis for typhoid ileal perforation. The objective is to provide evidence that may guide surgeons in selecting safer and more effective operative strategies tailored to this increasingly complex clinical scenario.

METHODS

The study was conducted in the Department of Surgery at CMH Hospital, Muzaffarabad, Azad Jammu and Kashmir, over a period of six months following approval of the research synopsis by the institutional ethical review committee. Ethical principles of the Declaration of Helsinki were adhered to throughout the study, and written informed consent was obtained from all participants prior to enrolment. The design adopted was a randomized controlled trial, which allowed for a comparative assessment of surgical site infections between two operative techniques used in patients with typhoid-associated small bowel perforation. A total of 70 patients were included in the study. The sample size was calculated using the WHO sample size calculator for public health, based on previously reported infection rates of 57.14% for ileostomy and 19.2% for primary repair, with a significance level of 5% and statistical power of 90%. Patients were recruited consecutively from those admitted to the surgical department and fulfilling the eligibility criteria. The inclusion criteria comprised patients aged between 13 and 60 years, presenting within 48 hours of symptom onset, and confirmed intraoperatively to have typhoid-associated small bowel perforation. Exclusion criteria included patients presenting with hypotension defined as mean arterial pressure (MAP) below 90 mmHg, malignancy detected on biopsy, diabetes mellitus, chronic steroid use, or traumatic perforation (11,12).

Randomization was achieved using the lottery method, and patients were allocated into two equal groups of 35 each. Group A underwent primary repair of the ileal perforation, while Group B underwent loop ileostomy. Standardized perioperative and postoperative care protocols were applied uniformly to both groups to minimize treatment bias. Postoperative follow-up continued for one month, during

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which patients were monitored for surgical site infection. Infection was identified clinically based on features such as localized swelling, erythema, and purulent discharge at the incision site. Data were recorded on a structured proforma by postgraduate surgical residents. Collected variables included demographic details, baseline characteristics, and outcome measures. Data analysis was performed using SPSS version 26. Descriptive statistics such as frequencies, percentages, and means with standard deviations were used to summarize data. Inferential statistics were applied using the Chi-square test to compare surgical site infection rates between the two groups, and a p-value of ≤0.05 was considered statistically significant. To control for potential confounders, stratification was carried out based on gender, age, and body mass index (BMI).

RESULTS

The two groups demonstrated comparable baseline characteristics. The mean age was 31.8 ± 10.5 years in the primary repair group and 32.6 ± 11.2 years in the loop ileostomy group, with no statistically significant difference (p = 0.678). Gender distribution was also similar, with males comprising 68% (24) and 66% (23) and females 32% (11) and 34% (12) in the respective groups (p = 0.831). The mean body mass index (BMI) was 22.4 ± 2.7 kg/m² in the primary repair group and 22.9 ± 3.1 kg/m² in the loop ileostomy group (p = 0.451). Time of presentation within 24 hours of symptom onset was recorded in 66% (23) of primary repair cases and 54% (19) of loop ileostomy cases, which was not statistically significant (p = 0.648). Clinical presentation was also comparable between both groups. Fever was reported in 90% (32) of primary repair and 94% (33) of loop ileostomy patients (p = 0.556). Abdominal pain was almost universal, occurring in 96% (34) and 98% (34) of patients respectively (p = 0.472). Nausea or vomiting was experienced by 80% (28) in the primary repair group and 82% (29) in the loop ileostomy group (p = 0.791). Diarrhea was present in 32% (11) versus 36% (13) (p = 0.706). Tachycardia, defined as heart rate >100 bpm, was observed in 56% (20) of primary repair and 64% (22) of loop ileostomy patients (p = 0.487), while hypotension (MAP <70 mmHg) was noted in 20% (7) and 24% (8) respectively (p = 0.709). Abdominal distension occurred in 76% (27) and 80% (28) of patients (p = 0.698), and guarding or rigidity was found in 60% (21) and 70% (25) respectively (p = 0.345). None of these variables showed statistically significant differences, confirming similarity in clinical presentation.

Postoperative outcomes demonstrated marked differences between the two groups. Surgical site infection was significantly higher in the loop ileostomy group, affecting 50% (18 patients), compared with 20% (7 patients) in the primary repair group (p = 0.001). The mean hospital stay was also significantly prolonged for loop ileostomy patients at 12.4 ± 3.3 days, compared to 7.6 ± 2.1 days for primary repair (p < 0.001). Electrolyte imbalance occurred in 36% (13) of loop ileostomy patients compared to only 8% (3) in the primary repair group, a highly significant difference (p = 0.001). Reoperation was required in 12% (4) of loop ileostomy patients compared to 6% (2) of primary repair patients, although this difference was not statistically significant (p = 0.289). Wound dehiscence was observed in 10% (3) of loop ileostomy and 4% (1) of primary repair cases (p = 0.436). Mortality was reported in 6% (2) of loop ileostomy patients and 2% (1) of primary repair patients, with no significant difference (p = 0.307).

Table 1: Demographic Characteristics (N = 70)

Variable	Primary Repair (n = 35)	Loop Ileostomy (n = 35)	p-value	Significance
Mean Age (years)	31.8 ± 10.5	32.6 ± 11.2	0.678	Not Significant
Gender				
Male	24 (68%)	23 (66%)	0.831	Not Significant
Female	11 (32%)	12 (34%)		
BMI (kg/m²)	22.4 ± 2.7	22.9 ± 3.1	0.451	Not Significant
Symptom Onset				
≤24h	23 (66%)	19 (54%)	0.648	Not Significant
>24h	12 (34%)	16 (46%)		

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Table 2: Clinical Presentation (N = 70)

Clinical Feature	Primary Repair (n = 35)	Loop Ileostomy (n = 35)	p-value	Significance
Fever	32 (90%)	33 (94%)	0.556	Not Significant
Abdominal Pain	34 (96%)	34 (98%)	0.472	Not Significant
Nausea/Vomiting	28 (80%)	29 (82%)	0.791	Not Significant
Diarrhea	11 (32%)	13 (36%)	0.706	Not Significant
Tachycardia (>100 bpm)	20 (56%)	22 (64%)	0.487	Not Significant
Hypotension (MAP <70 mmHg)	7 (20%)	8 (24%)	0.709	Not Significant
Distension	27 (76%)	28 (80%)	0.698	Not Significant
Guarding/Rigidity	21 (60%)	25 (70%)	0.345	Not Significant

Table 3: Postoperative Outcomes (N = 70)

Outcome	Primary Repair (n = 35)	Loop Ileostomy (n = 35)	p-value	Significance
Surgical Site Infection (SSI)	7 (20%)	18 (50%)	0.001	Significant
Mean Hospital Stay (days)	7.6 ± 2.1	12.4 ± 3.3	<0.001	Significant
Reoperation Required	2 (6%)	4 (12%)	0.289	Not Significant
Wound Dehiscence	1 (4%)	3 (10%)	0.436	Not Significant
Electrolyte Imbalance	3 (8%)	13 (36%)	0.001	Significant
Mortality	1 (2%)	2 (6%)	0.307	Not Significant

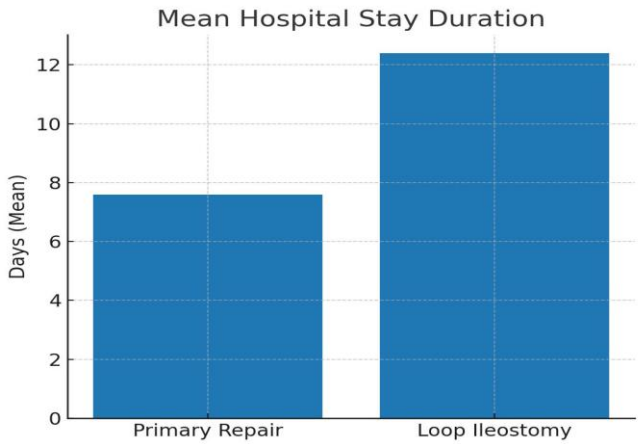

Figure 1 Mean Hospital Stay Duration

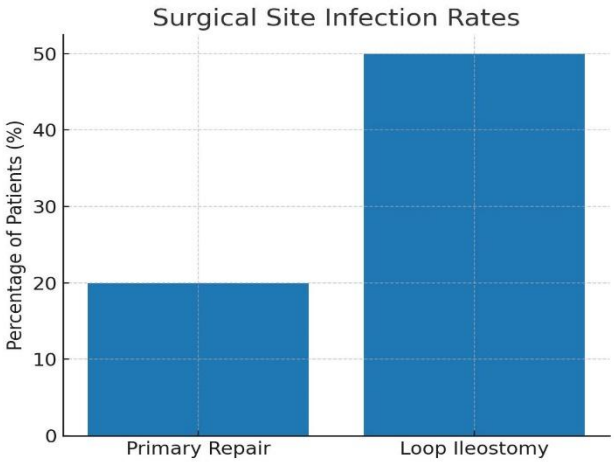

Figure 2 Surgical Site Infection Rates

DISCUSSION

The findings of this study demonstrated that the demographic and clinical characteristics of patients undergoing primary repair and loop ileostomy for ileal perforation were well-matched at baseline, indicating that the differences in outcomes were attributable to the surgical interventions rather than pre-existing patient factors. Age distribution, gender ratio, body mass index, and time of hospital presentation were comparable between both groups, as were the clinical presentations of fever, abdominal pain, nausea, vomiting, tachycardia, hypotension, abdominal distension, and peritonitis signs. These similarities enhance the internal validity of the trial, suggesting that the observed postoperative differences are directly linked to the chosen surgical techniques (10,11). Comparable baseline findings have been reported in other studies where patient characteristics did not influence postoperative outcomes between primary repair and diversion procedures (12,13). The results highlighted that surgical site infection was significantly higher in the loop ileostomy group compared with the primary repair group. This is consistent with existing research which has reported higher infection rates following diversion

procedures, often attributed to stoma-related complications such as leakage and complex care needs in low-resource environments (14–16). Prolonged hospital stay in ileostomy patients in this study further reinforced the burden associated with stoma care, echoing earlier observations where diversion procedures were linked to delayed recovery and extended hospitalization periods (17). Electrolyte imbalance emerged as a major postoperative complication among ileostomy patients, with significantly higher prevalence compared to those undergoing primary repair. This finding is in line with prior evidence highlighting increased risks of dehydration and electrolyte disturbances due to continuous fluid and potassium losses from the stoma, necessitating close monitoring and supplementation (18,19). Although reoperation and wound dehiscence rates were higher in the ileostomy group, the differences were not statistically significant. Similarly, mortality rates were slightly greater in the ileostomy group but without meaningful statistical association, reaffirming that while diversion increases postoperative morbidity, it does not necessarily worsen survival outcomes (20).

These findings carry important clinical implications. Loop ileostomy continues to hold value in patients with extensive peritoneal contamination, poor tissue viability, or unstable conditions, as it reduces the risk of anastomotic leakage in high-risk cases (21). However, the present study provides evidence that, in carefully selected and stabilized patients, primary repair offers better outcomes with reduced complications, shorter recovery periods, and improved overall tolerance (22). Adoption of primary repair in such patients may thus improve resource utilization, reduce hospital stay, and minimize the burden of stoma care. The strengths of this study include its randomized controlled design, balanced baseline characteristics, and standardized follow-up, which enhance the reliability of findings. However, certain limitations must be acknowledged. The use of consecutive sampling may have introduced selection bias, and the follow-up period of one month was relatively short to capture late complications such as stoma-related morbidity, fistula formation, or quality-of-life outcomes. Furthermore, the study relied on clinical criteria for diagnosing surgical site infections without microbiological confirmation, which may have led to under- or overestimation. Future research with larger multicenter trials, extended follow-up durations, and inclusion of patient-reported outcomes such as postoperative quality of life is warranted to establish definitive treatment guidelines. Overall, the study confirmed that primary repair is a safe and effective option for ileal perforation in selected patients, while loop ileostomy should remain reserved for those presenting with gross contamination or poor general condition. Integration of these findings into clinical practice may help refine surgical decision-making, reduce morbidity, and improve recovery outcomes for patients with typhoid ileal perforation.

CONCLUSION

This study concluded that primary repair offers a safer and more favorable surgical option for ileal perforation in carefully selected patients, as it is associated with fewer postoperative complications and faster recovery. Loop ileostomy retains its role in advanced cases with extensive contamination or unstable clinical status, where it can be lifesaving by reducing the risk of anastomotic failure. The findings emphasize the importance of individualized surgical decision-making, where patient stability and intraoperative conditions guide the choice of procedure. By tailoring operative strategies to patient needs, surgeons can optimize outcomes and improve overall management of ileal perforation.

AUTHOR CONTRIBUTION

Author	Contribution
Nadar Hussain*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Hamza Ali	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Aroosa Rubab	Substantial Contribution to acquisition and interpretation of Data

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Author	Contribution
	Has given Final Approval of the version to be published
Nawaid Farooque Khan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Tariq Bashir	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Amn Raana	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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